

# Comparison of Ship Loading Rates: Logs in Containers vs Bulk Cargo

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## Introduction

Approximately 7% of global industrial roundwood production is exported. In 2016 this equated to about 132 million m<sup>3</sup>. Most of the wood is exported as bulk cargo (Figure 1), but an increasing proportion is being exported in containers.

The opportunity to backload logs, in what may have been empty containers otherwise, is attractive to some shipping companies and competitive shipping prices can be offered.

It has been estimated that up to 60% of the cost of sales for logs exported to Asia is in marine freight and port costs. Ship loading rates effect total voyage times, port costs and potentially demurrage fees.

This FIRC Bulletin summarises a desktop study that was undertaken to compare estimated ship loading rates for logs exported in containers versus the more traditional exporting of logs as bulk cargo.

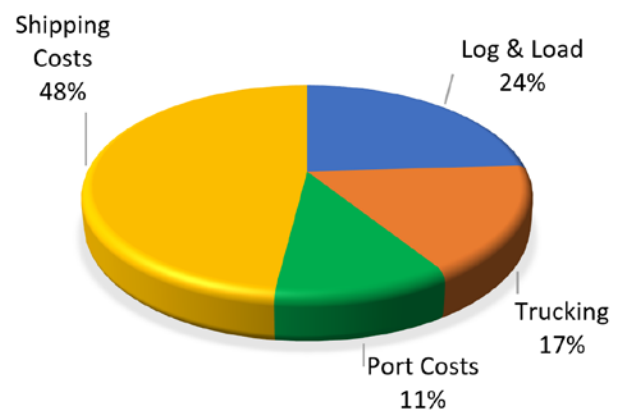


**Figure 1.** Most wood is exported as bulk cargo. In this figure logs are being removed from a wire sling by a small digger in the cargo hold. The digger also neatly places the logs to maximise storage volumes. (Source: C3 Ltd.)

## Importance of Port and Shipping Activities in the Supply Chain

Christie (1995) noted that shipping costs were approximately 50% and port costs were approximately 10% of the cost of sale of bulk logs from New Zealand to Asian markets (Figure 2). Activities included in cost of sales were logging and loading, cartage, port costs, and shipping costs.

Ship charter hire rates for Handysize vessels (typically used for bulk log exports from Australia and New Zealand) in 1995 were about US\$9000 per day, which are similar to what they were for container ships in mid-2018. Fifteen years later, in 2010, shipping costs were still estimated to be approximately 50% of the costs of sale of bulk logs (PF Olsen, 2010).



**Figure 2.** Cost of sales for export A-grade logs delivered to Asian markets from New Zealand (Adapted from Christie (1995)).

When a ship is in port three main sources of cost are incurred: the daily ship charter costs, any demurrage costs, and the port costs. Charter rates for container vessels have varied between US\$6000 and US\$11000 per day over the past three years. Demurrage is the cost a charterer of a ship incurs if the ship exceeds the allotted time for the voyage, usually due to in-port delays. Port costs are comprised of many services; for example, use of tug boats, loading and unloading costs, berth hire fees, provision of water, removal of rubbish, etc.

In 2007 the South Australian government undertook a review of port charges per visit for dry bulk vessels (includes wood chip and bulk log vessels) and container vessels (Meyrick and Associates 2007). Charges per visit ranged between \$55 and \$175 thousand. The great majority of the charges are fixed (e.g. pilotage) or cargo related (e.g. \$ per tonne or \$ per container). Only a small percentage of the costs were time related (\$ per day). Per diem berth costs average 6.5% of total port costs for dry bulk vessels (range 1 to 14%) and 4.8% for container vessels (range 1 to 10%).

## Study Methods

Data on bulk cargo load rates for logs were gathered by contacting industry personnel in Australia. Information from Australian sources was limited so this was supplemented with load rate information from New Zealand ports by contacting a New Zealand log marshalling company and by reviewing a recent dissertation on vessel load (Duval 2016). Load rates have been expressed in JAS m<sup>3</sup> per crane per hour.

Since load rates per vessel are partially dependent on the number of cranes loading the vessel, and crane numbers can vary per ship and per port, loads need to be expressed on a per crane per hour of work basis.

Data on container load rates was gathered quarterly by the Australian Bureau for Infrastructure, Transport and Regional Economics. This data was supplemented with container load rates (TEUs<sup>1</sup> per crane per hour) from New Zealand ports and other parts of the world. Although a forty-foot container is equivalent to two TEUs it takes the same time to load a forty-foot container as a twenty-foot container. For the purposes of this study crane rates can be thought of as containers per hour. To be able to express load rates in terms of JAS m<sup>3</sup> per hour per crane, it is necessary to have a measure of the number of JAS m<sup>3</sup> that can be loaded into each container.

Murphy et al (2018) carried out three case studies on eastern Australian ports that load logs into containers. Average load volumes from these case studies were used in this analysis. Sensitivity analysis to the assumed load volumes was carried out.

Handsize bulk cargo ships often have three to four cranes on-ship. Ports with container handling facilities around Australia appear to use two to four cranes to load ships. Handysize ships can handle up to 30,000 JAS m<sup>3</sup>. As well as comparing load rates on a JAS m<sup>3</sup> per crane per hour basis we will also compare them on the number of loading hours required per vessel assuming the utilisation of three cranes per vessel and loads of 10,000 to 30,000 JAS m<sup>3</sup>.

## Load Rates

### Bulk Cargo

Data on bulk cargo load rates for logs were gathered by contacting Load rates per crane per hour for Australian and New Zealand ports vary from 90 to 190 JAS m<sup>3</sup> per hour. Average load rates for Australia, adjusted for log grade and length, are about 140 JAS m<sup>3</sup> for loads delivered to shipside by road legal trailers and about 165 JAS m<sup>3</sup> for loads delivered by wide berth trailers. These averages are slightly higher than the New Zealand average (130 JAS m<sup>3</sup>) (range 107 to 162 JAS m<sup>3</sup>) but shipside tallying and scanning of log tickets is also part of New Zealand loading operations.

Crane rates at selected international ports: 2007-2011

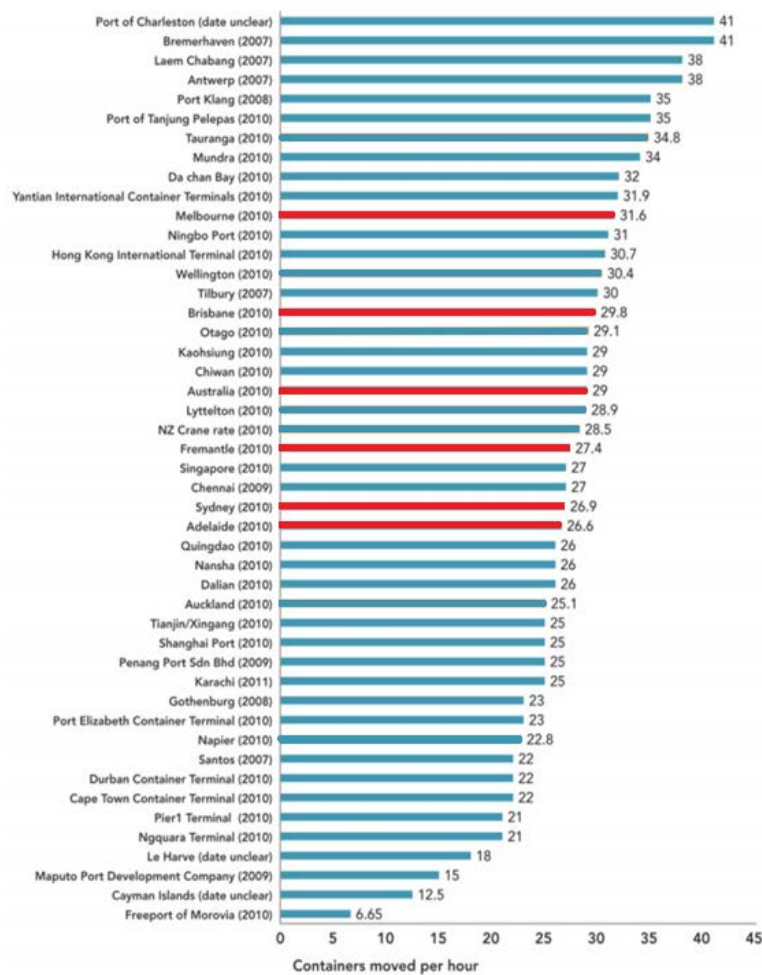


Figure 3. Container load rates for selected international ports, including five Australian ports (Melbourne, Adelaide, Fremantle, Brisbane and Sydney).

<sup>1</sup> Containers are reported in 20-foot equivalent units (TEU). A forty-foot container is equivalent to 2 TEUs.

### Logs in Containers

In 2011 the average load rate for five Australian ports included in a review of selected international ports was 28.5 containers per crane per hour (Ministry of Transport 2011) (Figure 3). By mid-2015 the average load rate for the same five Australia ports was 34.1 containers per hour.

Weight and volume were collected for 110 container loads of logs put into containers at three eastern Australian log yards. The average volume per container was 24.5 JAS m<sup>3</sup> and the average weight was 26.67 tonnes (Table 1). Volumes and weights varied with species, location, log length and grade.

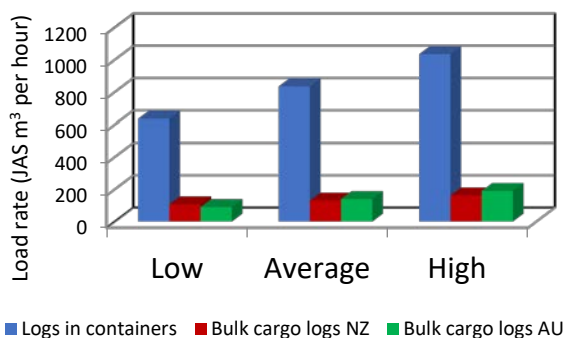
**Table 1.** Weight and volume statistics for three eastern Australian log yards which load logs into containers. (Source: Murphy et al, 2018)

Logyard	Number of containers	Volume per container (m <sup>3</sup> )	Weight per container (tonnes)
A	53	21.59	25.94
B	25	28.20	28.23
C	32	26.43	NA
Overall	110	24.50	26.67

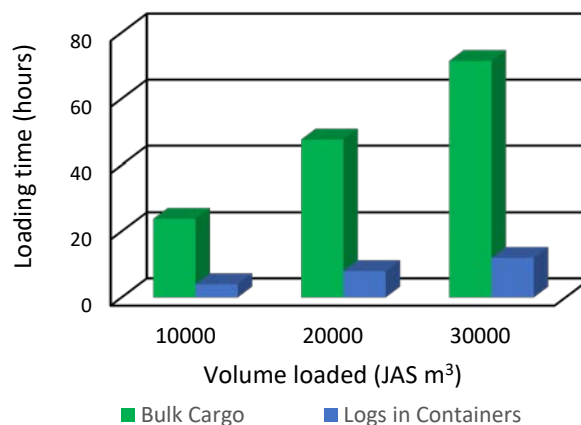
Based on an average number of containers loaded per crane per hour (34.1) and the average volume per container (24.5 JAS m<sup>3</sup>) average load rates of 835 JAS m<sup>3</sup> per crane per hour can be estimated for logs in containers. The range in estimated load rates could vary by plus or minus 200 JAS m<sup>3</sup> per hour per crane based on the variation in container load rates between Australia ports shown in Figure 3 and the variation in volumes per container shown in Table 1.

### System Comparisons

Estimated load rates (JAS m<sup>3</sup> per hour per crane) and ship loading times are substantially different when logs are loaded onto ships in container versus when they are loaded as bulk cargo (Figures 4 and 5).



**Figure 4.** Estimated load rates for logs loaded in containers versus as bulk cargo.



**Figure 5.** Estimated ship loading time for various load sizes for logs loaded in containers versus as bulk cargo.

Load rates, on average, are about six times faster when logs are loaded in containers than when they are loaded as bulk cargo.

There is an opportunity to further increase load rates for logs in containers, however. Containers with logs in them are frequently loaded onto ships partially full; they reach their weight limit before they reach their volume limit (Figure 6). Weight limits for 40 ft dry cargo containers are set by the SOLAS international shipping convention at 27,600 kg. Weight limits may be less than this depending on the road and rail transport regulations of the exporter's and importer's country.



**Figure 6.** Huangdao Container Terminal in China showing containers that are ¾ "ful" due to 25 metric ton weight restrictions. (Source: tptforests.com)

The University of the Sunshine Coast is currently conducting trials to determine what realistic volume gains per container can be obtained by removing bark and partial drying of logs before loading them into containers. Potential increases of 40 to 60% may be possible. If this can be achieved load rates of 1100 to 1300 JAS m<sup>3</sup> per crane per hour could be possible. Results of the debarking and drying trials will be reported in 2019.

## Discussions and Conclusions

Hummels (2007) commented that containerships are much quicker for loading and unloading than with bulk cargo. This comment is supported by our analysis which showed that average load rates for logs in containers were up to six times faster than those for bulk cargo logs. With debarking and partial drying of logs load rates could be as much as ten times faster. Faster load rates should mean shorter voyages, lower port costs and reduced likelihood of demurrage fees.

So why aren't more logs exported in containers. Loading logs into containers before they are loaded onto ship is an additional step in the forest to customer supply chain and requires time, space and cost. A 30,000 JAS m<sup>3</sup> cargo could be loaded onto ship in containers in a half day. Based on times reported in Murphy et al (2018) it would take 13 to 27 days to stuff this volume of logs into containers. One container loading operator in eastern Australia has commented that much more space is required for container loading operations than for bulk cargo; space is required to store the empty containers, to store the logs, and to store the loaded containers. Costs for loading logs into containers have been estimated by Murphy et al (2018) to be in the order of \$4 to \$10 per JAS m<sup>3</sup>.

The economic trade-offs between lower shipping and port costs and the additional costs of loading logs into containers is the subject of a separate FWPA funded project. This will be reported on in 2019.

## Acknowledgements

This bulletin is based on research that has been funded by Forest and Wood Products Australia. Reference to the full report is shown below.

## References

Murphy G. (2018) Comparison of ship loading rates: logs in containers vs bulk cargo. Project Report 1, Forest and Wood Products Association, 14 pages.

Full citations for other references cited in this Bulletin can be found on the FWPA Project Report cited above.

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### MORE INFORMATION

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